Lip-to-nose flap for nasal plane reconstruction in dogs: a cadaveric and in vivo feasibility study.

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Abstract: OBJECTIVE: To describe a local interpolation flap based on the upper lip for the reconstruction of the dorsal aspect of the nasal plane in dogs. STUDY DESIGN: Ex vivo and in vivo case report. ANIMALS: A 2-year-old medium-sized spayed female mixed-breed dog and a canine cadaver of a medium-sized mixed-breed dog. METHODS: A dorsal defect of the nasal plane of uncertain origin in a dog was reconstructed with a unilateral interpolation flap obtained from the caudal upper lip skin and mucosa (lip-to-nose flap). The procedure was first performed in a cadaveric model to assess its feasibility. RESULTS: The lip-to-nose flap allowed the reconstruction of a dorsal nasal plane defect with a satisfactory cosmetic outcome. The incorporation of the labial mucosa guaranteed a complete and uncomplicated wound healing of the flap; a small area of necrosis occurred at the donor site, which resolved in a few days. CONCLUSION: The use of a lip-to-nose flap was feasible in these 2 medium-sized dogs and led to satisfactory cosmetic outcome. CLINICAL SIGNIFICANCE: A lip-to-nose flap may be considered to reconstruct dorsal nasal plane defects in dogs and allows for a cosmetic outcome.

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LIP-TO-NOSE FLAP FOR NASAL PLANE RECONSTRUCTION IN DOGS: A CADAVERIC AND IN-VIVO FEASIBILITY STUDY

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Abstract

Objective – To describe a local interpolation flap based on the upper lip for the reconstruction of the dorsal aspect of the nasal plane in dogs.

Study Design – Ex-vivo and in-vivo case report.

Animals – 2-years medium-sized spayed female mixed-breed dog and a canine cadaver of a medium-sized mixed-breed dog.

Methods – A dorsal defect of the nasal plane of uncertain origin in a dog was reconstructed using a unilateral interpolation flap obtained form the caudal upper lip skin and attached labial mucosa (lip-to-nose flap). The procedure was first performed in a cadaveric model in order to assess its feasibility.

Results – The lip-to-nose flap allowed the reconstruction of a dorsal nasal plane defect with a satisfactory cosmetic outcome. The incorporation of the labial mucosa guaranteed a complete and uncomplicated wound healing of the flap, while a small area of necrosis occurred at the donor site, which solved in few days.

Conclusion – The lip-to-nose flap is feasible for the reconstruction of dorsal nasal plane defects in dogs and allows for a cosmetic outcome.

Introduction

Defects of the external nose in dogs are often caused either by traumatic injuries or by surgical resections of neoplasms such as squamous cell carcinoma.[1,2] Reconstruction of the nasal plane is particularly challenging in dogs because of the lack of free local tissue that can be used to reconstruct the original appearance of the nose.[3] The canine nose is a highly specialized structure and contributes to the appearance of the dog.[4] Thus, cosmetic and functional outcome are a great concern, and may limit the extent of the surgical excision in dogs with nasal neoplasia. For the same reasons, surgeons are cautious in performing nasal plane reconstruction in patients with traumatic injuries of the external nose. In Veterinary literature, several techniques based on local flaps have been proposed to allow primary closure of nasal defects. These techniques range from advancement flaps such as the dorsal muzzle and labial advancement, to composed flaps such as the bilateral alar cartilage and the musculofascial island labial flap.[4] Gallegos and colleagues reported a labial mucosal technique for reconstruction of defects involving the nasal plane and the rostral labial tissue.[5] The labial mucosal inversion technique improves cosmetic outcome and provides a labial mucosal antechamber protecting the nasal mucosa from direct exposure. This technique involves excision of a large portion of the upper lip adjacent to the nasal plane; it is thus not ideal for the reconstruction of dorsal defects without involvement of the rostral aspect of the nasal plane and upper lip. Recently a modified nasal rotational flap has been described for the reconstruction of a rostral nasal defect involving the lateral nasal plane in a dog.[3] Although the good cosmetic and functional outcome obtained, this technique can be hardly applied to nasal defects involving the very dorsal surface of the nasal plane.

The lip-to-lid flap is a local interpolation flap based on the caudal upper lip skin and the attached labial mucosa which has been successfully applied to replace the lower eyelid in dogs and cats. [6,7,8] The aim of this study is to report a modification of the lip-to-lid flap for the reconstruction of dorsal nasal defects in dogs and to assess its feasibility in a cadaveric and in-vivo model. The technique described

consists in a lip-to-nose interpolation flap based on the subdermal plexus, which allows direct mucosal apposition in order to obtain a good functional and cosmetic outcome.

Clinical Report

A 2-year-old mixed-breed, spayed female dog, weighting 21 kg was referred to Clinica Veterinaria Nervianese in February 2017, for a defect of the dorsal aspect of the nasal plane. The dog was found by a rescue association 10 days before with remote and recent history unknown. At clinical examination the dog presented a large defect of the nasal plane involving the rostral third of the nasal bones, the philtrum, and the dorsal lateral cartilages bilaterally. The lateral part of the alar cartilages and the ventral lateral cartilages were preserved (Figure 1). The rostral portion of the dorsal meatus was exposed, causing a chronical inflammation of the nasal mucosa. No other abnormalities were identified through physical examination. Haematological analysis revealed regenerative anaemia, neutrophilic lymphocytosis and hypoalbuminemia. Serum proteins electrophoresis pattern was consistent with a protozoarian infection and Hepatozoon canis was detected in the blood smear. Imidocarb dipropionate was thus administered at the dose of 6 mg/kg subcutaneously twice 14 days apart. A CT scan of the nose was performed and no other abnormalities were detected. Although no biopsy of the nasal tissue was performed in this case, we hypothesized that the nasal plane defect in this dog was of traumatic origin.

A decision was made to close the nasal defect with a lip-to-nose flap. The procedure was first performed on a canine cadaver of similar size in order to assess its feasibility (Figure 2). The cadaver was placed in sternal recumbency and the nose and lip were clipped. The flap was obtained from the upper lip as described by Pavletic for the lip-to-lid technique.[6] Two full-thickness incisions of the right upper lip were made starting from the medial cantus of the ipsilateral eye with a 45° angle form a line drawn between the medial and lateral canthi (Figure 2A-C). The two incisions were convergent and outlined so that the distance between the rostral and caudal edge of the flap corresponded to the minor diameter of the nasal plane lesion, with the caudal edge of the flap 3 cm rostral from the commissure (Figure 2A,B). The buccal mucosa was divided from the gingival mucosa and the whole buccal mucosa

was preserved to reconstruct the dorsal nasal mucosa. The skin was then undermined dorsally under the platisma muscle, and the skin flap with the attached lip margin was transposed to cover the nasal plane defect (Figure 2D-F). A bridging incision was created just proximal to the nasal plane lesion (Figure 2D). The mucosal edge of the flap was sutured to the remaining nasal mucosa with a simple interrupted pattern using monofilament absorbable sutures (Polidioxanone USP 3-0) (Figure 2G). The skin edge of the flap was then sutured to the nasal plane in two layers and the defect at the donor site was routinely closed in three layers with monofilament absorbable sutures (Figure 2G,H).

The cosmetic outcome was considered satisfactory and the same procedure was thus performed in-vivo. Total anesthesia was induced with propofol (6 mg/kg intravenously [IV]) and maintained with isoflurane in oxygen after intubation. Saline solution 0.9% was administered IV at the rate of 5 mL/kg/h during surgery. The dog was positioned in sternal recumbency. The nose and upper lip were clipped and aseptically prepared for surgery (Figure 3A). A composite flap was obtained following the technique as described in the cadaveric model, and the nasal plane defect was reconstructed using the lip-to-nose flap (Figure 3B-D). Great care was taken to preserve the subdermal plexus and to perfectly appose the skin edges of the flap. A vacuum drain (Emodren – Medicalplastic s.r.l., Milan, Italy) was placed to prevent seroma formation (Figure 3D). The defect at the donor site was closed with a labial advancement flap to avoid the exposure of the canine tooth. Pain was managed by fentanyl (5 mcg/kg/h continuous rate infusion IV) and local nerve block (bupivacaine 0.5% 1 mL) intraoperatively, and by methadone 0.1 mg/kg IV twice daily until discharge. Cefazolin (25 mg/kg IV twice daily) and Meloxicam (0.2-0.1 mg/kg IV once daily) were administered for 7 and 5 days respectively after surgery. The drainage was removed 2 days later and the patient was discharged 7 days postoperatively. Drug therapy for treatment of Hepatozoon canis infection was discontinued 14 days later.

Although the lip-to-nose flap did not allow for the reconstruction of the philtrum, the cosmetic outcome was improved and the motility of the external nose was preserved.

At discharge a small area of necrosis was noted at the donor site, probably due to the use of the monopolar electrosurgery, while the lip-to-nose flap appeared to be healed completely (Figure 4A,B). Necrosis at the donor site was treated with topic argentic sufadiazine and healed completely in 7 days. The patient showed minimal nasal discharge which resolved spontaneously 48 hours postoperatively. A small dog ear resulted from the transposition of the flap, which underwent a partial regression during the initial phase of the healing process. Fifteen days after surgery there were no signs of flap failure and both the nasal plane and the donor site were perfectly healed without evidence of nasal orifice stenosis. At 45 days, the patient had recovered uneventfully and the cosmetic and functional outcome were satisfactory (Figure 5A-C).

Discussion

In the case reported, a dorsal defect of the nasal plane in a dog was successfully reconstructed using a lip-to-nose interpolation flap based on the subdermal plexus. Primary closure techniques for a cosmetic reconstruction of the canine nasal plane are a great concern in Veterinary reconstructive surgery, and several techniques based on local flaps have been previously described.[3,5] However, none of these technique is ideal for the closure of dorsal defects. To the Authors' knowledge, no paper has yet reported a surgical technique based on a subdermal plexus flap specifically designed to cover dorsal nasal plane defects. The lip-to-lid flap has been largely employed for the reconstruction of the lower eyelid in dogs and cats and has showed a high rate of success.[6,7,8] The lip-to-nose flap here described similarly relies on the subdermal plexus and permits first intention healing with minimal tension. The upper lip represents a highly vascularized structure, with contribution from the infraorbital and lateral nasal artery; this may result in an improved success rate of the flap.[9]

The incorporation of the buccal mucosa permits a mucosal apposition which promotes primary wound healing with minimal scar tissue formation. This may prevent stenosis of the nostril as well as changes in the appearance of the external nose. Furthermore, the apposition of the buccal mucosa is crucial in protecting the nasal mucosa from the external environment, thus limiting the inflammation and the associated respiratory signs. In the case reported, the lip-to-nose flap healed completely without complications, no stenosis of the nostril was observed and a total remission of the nasal discharged due to the respiratory mucosa inflammation was achieved shortly after surgery.

The pigmented non-haired lip margin resembles the original appearance of the nose, and its incorporation allowed for a better cosmetic outcome. The dog ear resulting from the flap transposition showed a partial regression in the first days after surgery and did not require a surgical correction since it didn't compromise the overall cosmetic result.

The creation of the full-thickness flap from the upper lip is relatively simple to achieve and the lip-to-nose technique can be performed in a limited amount of time, thus reducing the risks associated with surgical timing.

The lip-to-nose flap is designed to cover dorsal defects of the nasal plane. In the case that we report the defect also involved the philtrum, which was not reconstructed. Nonetheless, the cosmetic appearance was not compromised and a functional reconstruction was achieved, since the motility of the external nose was preserved and no persistent nasal discharged occurred.

The defect that we treated was probably of traumatic origin. Nonetheless, it is the Authors' opinion that the lip-to-nose flap might be an effective option for the cosmetic closure of defects caused by surgical resection of neoplasm of the nasal plane. Furthermore, since the lip offers a discrete amount of free tissue, the flap obtained from the upper lip and the attached mucosa can be outlined to cover wider defects of the dorsal nasal plane or lesion which extend laterally.

Based on the results of the present study, the lip-to-nose flap is feasible for a single stage reconstruction of nasal plane defects in dogs and allows for a good cosmetic and functional outcome. However, additional studies based on a wider number of cases are needed to investigate further applications of the lip-to-nose flap and to assess its success rate.

Disclosure

The authors declare no conflict of interest related to this report.

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Figure Legends

Figure 1. Aspect of the defect. Note the exposure of the rostral portion of the dorsal meatus and the subsequent inflammatory hyperemia of the nasal mucosa; rostral (A) and dorsal (B) view.

Figure 2. Cadaveric model of the lip to nose flap for the reconstruction of dorsal nasal plane defects. A) The dorsal aspect of the nasal plane has been excised, and the rostral part of the resulting defect has been measured. B) The same distance has been measured on the lower lip to obtain the correct width of the mucosal edge of the flap. C) Two full-thickness incision of the upper lip have been made in order to create the flap; The two incisions extend from the medial chantus of the eye to the lower lip margin and form a 45° angle from a line drawn between the medial and lateral chanti. The whole buccal mucosa has been preserved to reconstruct the dorsal nasal mucosa (green arrow). D) A bridging incision has been made just proximal to the nasal plane defect (red arrow). E) The flap has been transposed to cover the nasal plane defect. F) The flap has been sutured in a simple continuous pattern to the recipient site and the lower lip has been reconstructed with an advancement flap. G) Completed reconstruction; right lateral view. H) Completed reconstruction; frontal view.

Figure 3. Lip-to-nose flap for the reconstruction of a dorsal nasal plane defect in a 2-year-old mixed-breed, spayed female dog. A) The defect involved the rostral third of the nasal bones, the philtrum, and the dorsal lateral cartilages bilaterally, while part of the alar cartilages and the ventral lateral cartilages were preserved. B) The flap has been obtained from the upper lip skin and the attached oral mucosa (blue arrow). C) The flap has been transposed to cover the dorsal defect. D) Oblique view of the muzzle after reconstruction; an active-suction drain has been placed.

287 Figure .4 Frontal (A) and left lateral view (B) at discharge. Note the small area of necrosis at the donor

288 site (blue arrow).

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290 Figure 5. Appearance of the dog 45 days after surgery; rostral (A) lateral (B) and dorsal view (C).